

What is Claimed is:

1. An apparatus for multilayer ion beam deposition, comprising:
  - (a) a process chamber having an interior space adapted to be maintained under vacuum conditions and including substrate mounting means within said chamber;
  - 5 (b) an ion beam source means within said process chamber for deposition of at least one film on a surface of a substrate held by said substrate mounting means;
  - (c) a plurality of gas supply means for supplying said ion beam source means with source gases for film deposition, each of said plurality of gas supply  
10 means including means for providing a substantially constant flow of source gas therefrom;
  - (d) a vacuum pump means connected to each of said plurality of gas supply means; and
  - (e) a plurality of valve means, including a valve means connected to  
15 each of said plurality of gas supply means and to said vacuum pump means for selectively supplying source gas from one of said plurality of gas supply means to said ion beam source means while venting source gases from all others of said plurality of gas supply means to said vacuum pump means, for maintaining said  
20 substantially constant flow of source gas from each of said plurality of gas supply means.
2. The apparatus according to claim 1, wherein:
  - each of said plurality of gas supply means supplies said ion beam source means with a different source gas for selective ion beam deposition of differently constituted films on said substrate surface.
3. The apparatus according to claim 1, further comprising:

(f) programmable gas flow controller means operatively connected to each said valve means for providing said selective supplying of said ion beam source means with source gas from one of said plurality of gas supply means.

4. The apparatus according to claim 3, wherein:  
each said valve means is pneumatically or electrically operated.

5. The apparatus according to claim 1, wherein:  
each of said plurality of valve means comprises a first valve means connected to a respective one of said plurality of gas supply means for supplying source gas therefrom to said ion beam source means and a second valve means  
5 connected to said one of said plurality of gas source means for venting source gas therefrom to said vacuum pump means.

6. The apparatus according to claim 5, wherein:  
each of said first and second valve means comprises a normally closed valve and said second valve means is open when said first valve means is closed, and *vice versa*.

7. The apparatus according to claim 1, wherein:  
each of said plurality of valve means comprises a valve means connected to a respective one of said plurality of gas supply means for alternately supplying source gas from said one of said plurality of gas supply means to said ion beam  
5 source means and venting source gas from said one of said plurality of gas supply means to said vacuum pump means.

8. The apparatus according to claim 7, wherein:  
each of said valve means comprises a three-way valve.

9. The apparatus according to claim 1, wherein:  
said vacuum pump means is also connected to said process chamber for maintaining said vacuum conditions within said interior space.

10. The apparatus according to claim 1, wherein:

said ion beam source means comprises a broad beam ion source.

11. The apparatus according to claim 11, wherein:

said broad beam ion source comprises an end-Hall type ion beam source or a Kaufman type ion beam source.

12. A method for multilayer ion beam deposition utilizing a common ion beam source, comprising the steps of:

(a) providing an ion beam deposition apparatus comprising:

5 i. process chamber having an interior space maintained under vacuum conditions and including substrate mounting means therein;

ii. an ion beam source means within said process chamber for performing said multilayer deposition;

10 iii. plurality of gas supply means for supplying said ion beam source means with source gases for said multilayer deposition, each of said plurality of gas supply means adapted for providing a constant flow of source gas therefrom;

iv. vacuum pump means connected to each of said plurality of gas supply means; and

15 v. plurality of valve means, including a valve means connected to each of said plurality of gas supply means and to said vacuum pump means for selectively supplying source gas from one of said plurality of gas supply means to said ion beam source means while venting source gas from all others of said plurality of gas supply means to said vacuum pump means;

20 (b) providing said substrate mounting means with a substrate having at least one deposition surface; and

(c) ion beam depositing said multilayer film on said at least one substrate deposition surface, said ion beam depositing including the sequential steps of:

25           i.       establishing a substantially constant flow of source gas from each of said plurality of gas supply means to said vacuum pump means;

          ii.       opening the valve means connected to a selected one of said plurality of gas supply means for supplying source gas therefrom to said ion beam source means and closing the valve means connecting said  
30       selected one of said plurality of gas supply means to said vacuum pump means, while maintaining closed the valve means connected to all others

          of said plurality of gas supply means for supplying source gas therefrom to said ion beam source means and maintaining open the  
35       valve means connecting all others of said plurality of gas supply means to said vacuum pump means;

          iii.      ion beam depositing on said at least one substrate surface a layer of a selected material having a desired thickness, utilizing the source  
          gas supplied to said ion beam source means from the selected one  
40       of said plurality of gas supply means;

          iv.      upon completion of said ion beam depositing of said layer of selected material, closing the valve means connected to said selected one of said plurality of gas supply means for supplying source gas therefrom to said ion beam source means and opening the valve means  
45       connecting said selected one of said plurality of gas supply means to said vacuum pump means; and

          v.       repeating steps ii. - iv., as desired, to selectively supply source gas from at least one other of said plurality of gas supply means, thereby to deposit said multilayer film on said at least one substrate deposition  
50       surface.

13. The method according to claim 12, wherein:  
step (c) comprises utilizing a programmable gas flow controller means operatively connected to each of said valve means for selectively supplying of said ion beam source means with source gas from said one of said plurality of gas supply means.
14. The method according to claim 13, wherein:  
each of said valve means is pneumatically or electrically operated.
15. The method according to claim 12, wherein:  
step (b) comprises providing a substrate including at least one magnetic or magneto-optical (MO) recording layer on said at least one deposition surface; and  
step (c) comprises ion beam depositing a multilayer protective overcoat over said at least one magnetic or MO recording layer.
16. The method according to claim 15, wherein:  
step (c) comprises ion beam depositing a plurality of differently constituted carbon-based layers.
17. The method according to claim 16, wherein:  
step (c) comprises ion beam depositing a plurality of hydrogen-doped carbon-based layers of different hydrogen content.
18. The method according to claim 16, wherein:  
step (c) comprises ion beam depositing at least one undoped carbon-based layer and at least one doped carbon-based layer.
19. The method according to claim 18, wherein:  
step (c) comprises ion beam depositing at least one doped carbon-based layer selected from hydrogen-doped carbon and nitrogen-doped carbon.
20. An apparatus for multilayer ion beam deposition, comprising:

an ion beam source means; and

means for selectively supplying said ion beam source means with source  
gas from one of a plurality of gas supply means while maintaining a substantially  
5 constant flow of source gas from each of said plurality of gas supply means.